

REMARKS

This application has been carefully reviewed in light of the Office Action dated July 10, 2007. Claims 4, 5, 7 to 13, 23 and 24 are in the application, of which Claims 4 and 13 are still the only independent claims. Reconsideration and further examination are respectfully requested.

Formal objections were lodged against Claims 5 and 10. With respect to Claim 10, the requested change has been made. No change has been made in Claim 5, however, since the language of the claim is believed to be correct. Specifically, Claim 5 is directed to a fluid communication structure, and the substance of Claim 5 indicates that in use of this structure, it is positioned substantially below a liquid containing section and substantially above a liquid consuming section. This description seems accurate, whereas the language suggested in the Office Action seems less so. Accordingly, no change has been made.

All claims were rejected for obviousness-type double patenting over certain claims of U.S. Patent Application Publication 2004/0061748 and over certain claims of U.S. Patent Application Publication 2005/0068394. The rejections were non-provisional rejections, and they were entered over pre-grant publications of pending patent applications. The rejections are therefore traversed on this basis. Specifically, it is improper to enter a non-provisional double patenting rejection over anything that is not an issued patent. Obviousness-type double patenting rejections are "grounded in public policy so as to prevent the unjustified or improper timewise extension of the right to exclude

granted by a patent". See MPEP § 804. Thus, in the absence of an issued patent and patented claims, there cannot be any "timewise extension" and a non-provisional rejection for obviousness-type double patenting must be withdrawn.

It is respectfully pointed out that both of the cited pre-grant publications have issued as patents: see U.S. Patent 6,969,161 and U.S. Patent 7,128,407, respectively. It is the Applicants' view that these patents have issued with claims that differ from those in their corresponding pre-grant publications, such that a rejection for obviousness-type double patenting over the patented claims is not warranted. However, the Examiner is respectfully requested to review these two issued patents for herself, and to make this determination independently.

Applicants thank the Examiner for her indication of allowable subject matter in dependent Claims 9 and 15. In keeping with this indication, the substance of Claim 15 (together with intervening Claim 14) has been incorporated into independent Claim 13, and Claims 14 and 15 have consequently been cancelled. Claim 13 is therefore believed to be in condition for allowance.

Claim 9 has not been rewritten in independent form, however, since it is believed that its base Claim 4 is also in condition for allowance, as discussed below.

Claims 4 to 8, 10 to 14, 23 and 24 were rejected under 35 U.S.C. § 102(a) or § 103(a) over Japan 5-96744 (Kataoka). In entering the rejection, the Office Action asserts that Kataoka's first chamber 11 corresponds to the claimed liquid chamber. The rejection is therefore respectfully traversed, as explained in more detail below.

In one aspect, the invention concerns a fluid communication structure comprising a liquid chamber communicating with a liquid consuming section and plural communication channels for providing communication between the liquid chamber and a liquid containing section. Among other features, the liquid chamber forms a substantial closed space except the plural communication channels.

Kataoka describes an ink supply mechanism in which first chamber 11 and second chamber 15 communicate with each other through a capillary tube 14. As shown in Kataoka's Figure 1, however, first chamber 11 includes an atmosphere conduction hole 12, and thus does not form a "substantially closed space" as set out in the claims.

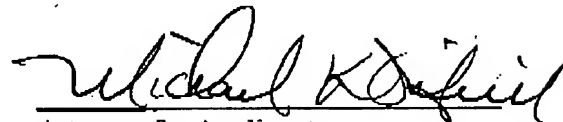
Kataoka is in Japanese, and to facilitate consideration of this reference, a computer-generated translation has been obtained from the web site of the Japanese Patent Office. A copy of this computer-generated translation is attached to this amendment. Since the translation is computer-generated, and has not been reviewed by anyone conversant in both Japanese and English, it naturally contains numerous errors and omissions, and is clearly non-grammatical. Nevertheless, and in spite of these inaccuracies, it is felt that the translation is helpful for understanding the general nature of the technological content of Kataoka.

In any event, the claims herein include significant other features. For example, Claim 4 has been amended with the subject matter of now-cancelled Claim 6, so as to specify that the plural communication channels have different heights of their opening positions in the liquid chamber side with reference to a vertical direction. It is respectfully submitted that when considered as a whole, the subject matter of independent Claim 4 is

not anticipated by Kataoka, and would not have been obvious to those of ordinary skill in the art based on the disclosure of Kataoka. Withdrawal of the rejections is respectfully requested.

Applicants' undersigned attorney may be reached in our Costa Mesa, California office at (714) 540-8700. All correspondence should continue to be directed to our below-listed address.

Respectfully submitted,



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Machine-Generated Translation of JP 5-96744 (Kataoka Masaki, et al), obtained from the JPO's Industrial Property Digital Library at http://www.ipdl.inpit.go.jp/homepg_e.ipdl on September 21, 2007

PATENT ABSTRACTS OF JAPAN

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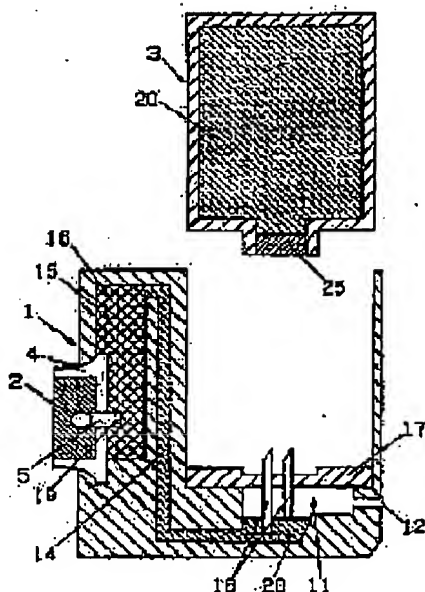
TAKAO NOBUYUKI

(54) INK SUPPLY MECHANISM FOR INK JET PRINTER

(57)Abstract:

PURPOSE: To provide an ink supply mechanism for ink jet printer in which availability of ink in an ink cartridge is high and residual quantity of ink can be detected easily.

CONSTITUTION: A head cartridge section 1 comprises first and second chambers 11, 15 communicated each other through a capillary tube 14. The second chamber 15 is provided with a porous member 16 whereas the first chamber 11 is provided with an atmosphere conduction hole 12 and two communication paths 18. When an ink cartridge 3 is fixed to the head cartridge section 1, air is fed into the cartridge through the communication path 18



and ink is fed into the first chamber 11. When the ink level exceeds over the end part of the communication path, ink supply is stopped due to pressure balance. When ink is consumed due to printing, ink is fed from the porous member 16 to the recording head 2 and the porous member 16 is fed with ink from the first chamber 11.

LEGAL STATUS [Date of request for examination] 19.08.1997
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* NOTICES *

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1. This document has been translated by computer. So the translation may not reflect the original precisely.

2. **** shows the word which can not be translated.

3. In the drawings, any words are not translated.

CLAIMS

[Claim(s)]

[Claim 1] In the ink feeder style of the ink jet printer with which the ink cartridge was constituted by the head cartridge section disengageable said ink cartridge It is the structure of storing ink in the sealed container. Said head cartridge section The joint section with said ink cartridge, and the 1st ** which is prepared near [the joint section] this and has opening with atmospheric air, It is the ink feeder style of the ink jet printer which has the 2nd ** which is open for free passage to this 1st **, and has a porous member, and is characterized by said joint section consisting of two or more free passage ways where the height of opening by the side of said 1st ** differs.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Industrial Application] This invention relates to the ink feeder style of the ink jet printer with which the head cartridge section and an ink cartridge were separated.

[0002]

[Description of the Prior Art] In the ink jet printer using an ink cartridge, the liquid ink side of an ink cartridge may become higher than the nozzle side of a recording head on a printer configuration. In such a case, the water head differential pressure by difference of height joins the nozzle side of a recording head, and ink flows out from a nozzle. In order

to prevent this, the method of giving negative pressure is used in the inside of an ink tank, and the negative pressure generating means was needed.

[0003] As an approach of holding ink in the ink cartridge, into the ink tank, porous members, such as sponge, are arranged, and the method of making ink hold using the capillary tube force is common, and is widely used as indicated by JP,63-87242,A and JP,32-34349,A.

[0004] However, by this approach, sponge cannot be completely filled up with ink, but there is a problem that ink enters about 70% of the volume of an ink cartridge, moreover, some ink with which sponge was filled up remains to sponge, and it has the problem that it is used about 80% of the ink with which it filled up. For this reason, there was use effectiveness of the volume of an ink cartridge only about 50 to 60%, and since the use effectiveness of about [that the miniaturization of a cartridge is difficult] and ink was bad, it had checked low-pricing of a running cost. Moreover, since sponge is filled up with ink, the problem of being difficult also has residue detection of ink.

[0005] Moreover, the method of preparing a pressure regulating valve between an ink tank and a recording head was also proposed as indicated by JP,62-231759,A, but since this approach produced an ink leak from an ink tank when it is easy to produce failure of a pressure regulating valve and breaks down by plugging by breakage, dust, etc. of a valve etc., it was not suitable for actual use.

[0006]

[Problem(s) to be Solved by the Invention] This invention was made in view of the situation mentioned above, and its use effectiveness of the ink in an ink cartridge is high, and it aims at offering the ink feeder style of the ink jet printer which can make residue detection easy.

[0007]

[Means for Solving the Problem] In the ink feeder style of the ink jet printer with which, as for this invention, the ink cartridge was constituted by the head cartridge section disengageable said ink cartridge It is the structure of storing ink in the sealed container. Said head cartridge section The joint section with said ink cartridge, and the 1st ** which is prepared near [the joint section] this and has opening with atmospheric air, It has the 2nd ** which is open for free passage to this 1st **, and has a porous member, and said joint section is characterized by consisting of two or more free passage ways where the height of opening by the side of said 1st ** differs.

[0008] A filter can be prepared in the connection way from [from said 2nd **] the inside of the connection way to a head, or said 1st **. Capillary tubes, such as a capillary or a porous member, are made to intervene between the 1st ** and the 2nd **, and you may make it hold ink according to the capillary force.

[0009]

[Function] The ink stored in the ink cartridge is supplied to the 1st ** through the joint section. The inside of an ink cartridge is sealed and atmospheric-air disconnection of the 1st ** is carried out. The joint of an ink cartridge and the 1st ** is carried out on two or more free passage ways, and, as for the opening edge by the side of the 1st [of these two

or more free passage ways] **, the difference of elevation is prepared. Therefore, since Ayr is supplied through a free passage way from the 1st ** when there is no ink in the 1st **, ink is supplied to the 1st ** by gravity through a free passage way. If the ink level of the 1st ** arrives at the opening edge of all free passage ways, Ayr will no longer be supplied to an ink cartridge, and supply of the ink to the 1st ** will stop by the negative pressure in an ink cartridge, and the equilibrium of ink weight.

[0010] The ink controlled by the 1st ** by fixed level is supplied to the 2nd **. Capillary tubes, such as a capillary or a porous member, can be made to be able to intervene between the 1st ** and the 2nd **, and the ink of a free passage way can be held according to the capillary tube force. In the 2nd **, ink is held by the porous member and moderate negative pressure is given to the recording head. If ink is consumed by printing and ink is sent to a recording head from the porous member of the 2nd **, the negative pressure of the 2nd ** will become large and ink will be supplied to the 2nd ** from the 1st **.

[0011] If the ink level in the 1st ** becomes lower than an opening edge with a higher free passage way, Ayr will be supplied to an ink cartridge and ink will be supplied to the 1st ** from an ink cartridge. The ink level of the 1st ** will rise, will be in the equilibrium state mentioned above, and supply of the ink from an ink cartridge stops.

[0012]

[Example] Drawing 1 is the sectional view showing the outline of the 1st example of the ink feeder style of this invention. the inside of drawing, and 1 -- the head cartridge section and 2 -- a recording head and 3 -- an ink cartridge and 4 -- a heat sink and 5 -- a manifold and 11 -- the 1st ** and 12 -- an atmospheric-air free passage hole and 14 -- a capillary tube and 15 -- for the joint section and 18, as for a filter and 20, a free passage way and 19 are [the 2nd ** and 16 / a porous member and 17 / ink and 25] elastic bodies. The head cartridge section 1 and an ink cartridge 3 are constituted disengageable, and casing of an ink cartridge 3 is guided and positioned by the housing guide which was formed in housing of the head cartridge section 1 and which is not illustrated.

[0013] The heat sink 4 with which the recording head 2 was attached in the head cartridge section 1, the printed-circuit board which supplies an electrical signal to a recording head (not shown), Two free passage ways for connection with the manifold 5 and ink cartridge which supply ink to a recording head are formed, and the capillary tube 14 which connects 1st ** 11 which stores ink, 2nd ** 15 which has the porous member 16, and the 1st ** and 2nd ** is formed in one. The atmospheric-air free passage hole 12 is formed in 1st ** 11, and 1st ** 11 is kept always equal to atmospheric pressure to it. The atmospheric-air free passage hole 12 serves as a detailed hole, in order to prevent that ink flows out. As a porous member 16, the urethane foam whose average boar size is 200 micrometers was used in this example. Many nozzles (not shown) are formed in the recording head 2 by high density. In this example, 128 nozzles are formed by the high density of 300spi(s). Each nozzle is made to generate air bubbles by energization, and the heating element (not shown) for injecting an ink droplet is prepared in it. In drawing 1, injection of an ink droplet is performed sideways.

[0014] An ink cartridge 3 consists of ** and the elastic body 25 which store ink 20. An elastic body 25 is for making easy connection with the head cartridge section 1, and after

ink had remained, also when an ink cartridge 3 is removed, it does not have ink leakage. In order for the case of an ink cartridge 3 to have rigidity and to enable long-term ink maintenance, the good ingredient of ink-proof nature is chosen.

[0015] Actuation is explained. First, the case where an ink cartridge 3 is attached in the head cartridge section 1 is explained. Two free passage ways 18 where the tip attached in the head cartridge section 1 is sharp when an ink cartridge 3 is positioned according to the housing guide which was formed in housing of the head cartridge section 1, and which is not illustrated penetrate the elastic body 25 of an ink cartridge 3, and arrive at an ink room. Since 1st ** 11 is wide opened by atmospheric air at this time, Air is inhaled from the free passage way 18 in the ink interior of a room of an ink cartridge 3, and ink is supplied to 1st ** 11 in the head cartridge section 1 by gravity through the free passage way 18. If the ink level in 1st ** 11 arrives at the edge of the free passage way 18 whose number is two, supply of Air into an ink cartridge 3 will be suspended. Then, if the ink of a particle is supplied to the head cartridge section 1, the inside of an ink cartridge 3 will be in a negative pressure condition. When this negative pressure and the weight of the ink residue in an ink cartridge 3 balance, ink supply in the head cartridge section 1 is suspended. Thus, the ink level in 1st ** 11 in the head cartridge section 1 is controlled uniformly.

[0016] The ink in 1st ** 11 is supplied to 2nd ** 15 through a capillary tube 14. In 2nd ** 15, ink is held by the porous member 16. At this time, the ink pressure committed to a recording head 2 is mostly determined by the difference of elevation of 1st ** 11 and a recording head 2, and the capillary force of a capillary tube 14 and the capillary force of the porous member 16. The dimension of the head cartridge section 1 and the quality of the material of the porous member 16, and boar size are selected so that this ink pressure may become the value suitable for printing, for example, -20 - -130mmH₂O.

[0017] The time of printing actuation is explained. Printing consumption of ink sends the ink with which the porous member 16 of 2nd ** 15 is filled up to a recording head 2. The pressure of 2nd ** 15 declines and, as for 2nd ** 15, ink is supplied by this from 1st ** 11 through a capillary tube 14. Thus, the ink of the almost same amount as the amount of ink consumed by printing is supplied to 2nd ** 15 from 1st ** 11.

[0018] When the ink level in the 1st ** became lower than the opening edge of the higher one of the free passage way 18, as it mentioned above by consumption of ink, Air is supplied to an ink cartridge 3 and ink is supplied to 1st ** 11 from an ink cartridge 3. The ink level of 1st ** 11 will rise, will be in the equilibrium state mentioned above, and supply of the ink from an ink cartridge 3 stops. Since the ink of a constant rate is held at the porous member 16 in 2nd ** 15 even after the ink of an ink cartridge 3 is lost and all the ink of 1st ** 11 is consumed, there are few possibilities of carrying out air ejecting.

[0019] It is formed by transparence and the translucent member, or the inspection hole (not shown) etc. is prepared, and the case of an ink cartridge 3 has composition which can get to know an ink residue easily visually.

[0020] In order that two free passage ways 18 may prevent the inflow of rapid ink, size with sufficient passage resistance is chosen. However, since the ink of a constant rate is stocked by the porous member 16 in 2nd ** 15 even when the ink consumption in a recording head becomes great, there is no possibility of performing air ejecting.

[0021] Drawing 2 is the sectional view showing the outline of the 2nd example of the ink feeder style of this invention. Among drawing, the same sign is given to the same part as drawing 1, and explanation is omitted. For 6, as for 4 and 8, a lever and 7 are [a guide member and 13] film members. Clear separation is not made but the 1st ** 11 and 2nd ** 15 are connected with this example almost straight. In supply of the ink from 1st ** 11 to 2nd ** 15, since the capillary force of the porous member 16 is used, the lower limit section of the porous member 16 is installed in the location lower than the ink level in 1st ** 11. According to this example, the structure of the head cartridge section 1 becomes simple to the 1st example, and while a miniaturization is easy, early ink restoration is easy and dependability's over mixing of air bubbles improves.

[0022] The film member 13 is a film member which was not prepared in order that ink might prevent the leakage by the exterior from the atmospheric-air free passage hole 12, and does not let through and ink pass only for air. The guide member 8 is what used the flat-spring-like elastic body, and is prepared in the object for positioning and the object for vibration isolation of an ink cartridge 3. Moreover, the lever 6 is formed in order to make easy removal of the ink cartridge 3 from the head cartridge section 1. An ink cartridge 3 can be pushed up upwards by rotating a lever 6 around supporter 6a.

[0023] Drawing 3 is the sectional view showing the outline of the 3rd example of the ink feeder style of this invention. Among drawing, the same sign is given to the same part as drawing 2, and explanation is omitted. In this example, the free passage way 18 from an ink cartridge 3 to 1st ** 15 is formed with one double pipe, and it is a thing. Thereby, the miniaturization of a joint part with an ink cartridge 3 can be attained.

[0024] Drawing 4 is the sectional view of the part of the communicating tube in the 4th example of the ink feeder style of this invention. Two free passage ways are formed by one metal double pipe like the 3rd example. the inside of drawing, and 1 -- the head cartridge section and 3 -- for ink and 22, as for an electrode and 24, a contact terminal and 23 are [an ink cartridge and 18 / a free passage way and 20 / a connection terminal and 25] elastic members. According to this configuration, the ink level in the head cartridge section 1 is controlled in the lower limit section of the outer tube of the free passage way 18. Moreover, in this example, conductive ink is used as ink 20. By equipping the head cartridge section 1 with an ink cartridge 3, a contact terminal 22 and an electrode 23 contact and circuit connection is made. Since the electrode 23 is exposed in an ink cartridge 3, when there is an ink residue, since the circuit of the contact terminal 22-electrode 23-ink 20-free passage way 18 is completed, it is possible by connecting the connection terminal 24 to a printer side to sense electrically an ink residue and the type compatibility of the installation existence of an ink cartridge and a cartridge by the printer side.

[0025] Drawing 5 is the sectional view showing the outline of the 5th example of the ink feeder style of this invention. Among drawing, the same sign is given to the same part as drawing 2, and explanation is omitted. In this example, a recording head 2 carries out the regurgitation of the ink droplet to above [of drawing]. 26 is the ink droplet injected by the recording head 2. An ink cartridge 3 is attached in the head cartridge section 1 from a longitudinal direction. 1st ** 11 is wide opened by atmospheric pressure with the atmospheric-air free passage hole which is not illustrated. In this example, it is formed so

that moderate passage resistance and the moderate amount of supply may be obtained because the free passage way 18 ties up many capillary tubes (not shown) into a knot.

[0026] Drawing 6 is the sectional view showing the outline of the 6th example of the ink feeder-style of this invention. Among drawing, the same sign is given to the same part as drawing 2, and explanation is omitted. As for the 2nd atmospheric-air free passage hole and 10, 9 is [the 2nd film member and 21] the 2nd filter. In this example, a recording head 2 carries out the regurgitation of the ink droplet to down [of drawing]. Since the thing of a printer for which 1st ** 11 is arranged in an upper location from a recording head 2 is difficult constitutionally when performing downward printing, it becomes impossible thus, to set ink ** to a recording head 2 as a proper value according to the configuration shown in each example mentioned above. So, in this example, while preparing the atmospheric-air free passage hole (not shown) for opening 1st ** 11 to atmospheric air, the free passage way to which the 1st ** 11 and 2nd ** 15 are connected was once taken about up, that interior was filled up with the porous member 16, and the 2nd atmospheric-air free passage hole 9 equipped with the 2nd film member 10 in the upper part was formed from 1st ** 11. Therefore, ink ** to a recording head 2 is mostly determined with the holding pressure of the porous member 16, and can set up the optimal pressure for printing which was mentioned above. In this case, as for the holding pressure of the porous member 16, it is desirable for a thing with the holding pressure more than the difference of elevation of the ink level of 1st ** 11 and the location of the 2nd atmospheric-air free passage hole 9 to be chosen, and to choose the member from which it is the atmospheric-air free passage hole 9 neighborhood, and making a porous member into discontinuity and/or holding pressure differ. The 2nd filter 21 can prevent mixing of the dust from the porous member 16 side to 1st ** 11 etc., and adjustment of ink level can be realized with high dependability.

[0027] In addition, this invention is not limited to the above-mentioned example, and includes all the configurations included in a claim. For example, it is possible to make the inside of an ink cartridge into the film material of the non-permeability as an ink attaching part and two rooms of the air chamber section etc.

[0028]

[Effect of the Invention] Since the differential pressure by the difference of elevation of an ink tank and a recording head is intercepted in the joint section with an ink cartridge according to this invention so that clearly from the above explanation, it does not need to be filled up with porous members, such as sponge, into an ink tank. Therefore, by forming the case of an ink cartridge by transparence and the translucent member, or preparing an inspection hole etc., the residue of ink can be detected visually and small and low cost-ization can be performed compared with the cartridge of the ink of tales doses.

[0029] Moreover, ink cannot remain to a porous member, about 100% of ink can be used for printing, and since the ink cartridge itself is made to simplicity and low cost structure, it is further effective in the ability to also reduce a running cost greatly.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is the sectional view of the 1st example of the ink feeder style of this invention.

[Drawing 2] It is the sectional view of the 2nd example of the ink feeder style of this invention.

[Drawing 3] It is the sectional view of the 3rd example of the ink feeder style of this invention.

[Drawing 4] It is the sectional view of the free passage way of the 4th example of the ink feeder style of this invention.

[Drawing 5] It is the sectional view of the 5th example of the ink feeder style of this invention.

[Drawing 6] It is the sectional view of the 6th example of the ink feeder style of this invention.

[Description of Notations]

1 Head Cartridge Section, 2 Recording Head, 3 Ink Cartridge, Four heat sinks, 5 A manifold, 6 A lever, 7 Ayr, 8 a guide member and 9 -- the 2nd atmospheric-air free passage hole and 10 the 2nd film member -- 11 The 1st **, 12 An atmospheric-air free passage hole, 13 A film member, 14 Capillary tube, 15 The 2nd **, 16 A porous member, 17 The joint section, 18 A free passage way, 19 A filter, 20 Ink, the 21 2nd filter, 22 A contact terminal, 23 An electrode, 24 A connection terminal, 25 An elastic member, 26 Ink droplet.

[Translation done.]

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